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Eryops; Eryopsoides, Gen. Nov. from the New Mexico Permian.

BY HERMAN DOUTHITT.

SKULL STRUCTURE.

THE statements made herein are based upon the study of eight skulls in the University of Chicago collection, some incomplete, and some only partly uncovered at the present time; one incomplete skull loaned from the Yale Museum for the purpose (No. 826); one skull and fragmentary material from the University of Kansas collection; and descriptions by Branson, Case and Broom. Shortly after this work was undertaken, in the fall of 1913, a paper by Broom appeared which covered to a large extent the same field. The morphological part, therefore, is presented mainly as a review and criticism of the work of Broom.

The structure of the upper surface of the skull was found to offer no disagreements from the results made known by the investigations of Branson, Case and Broom, and need not be discussed here. A few slight disagreements were found, which represented probably mere individual differences.

The occipital region and base of the skull were found to agree with the accounts of Broom, except that there is considerable evidence that the supraoccipital is present. No separation could be made out of the elements designated by Broom as basisphenoid and sphenethmoid, but there appears no reason for doubting his determination. As regards the supraoccipital, evidence of its presence is provided by one small, apparently immature, skull. The sutures extend from just dorsad of the condyles, dorsad and laterad, the supraoccipital thus forming more than one-half of the border of the foramen magnum. None of the larger skulls at hand give satisfactory evidence of its presence, though several are well preserved.

It seems, therefore, that the supraoccipital was present in *Eryops*, but that in adult life the element was fused with the exoccipitals. Its presence would be logically expected, since the postparietal is clearly excluded from the foramen magnum. To have the two exoccipitals meet and fuse above would be decidedly unusual; and even if no trace of sutures were to be found, it would be logical to interpret the upper part as supraoccipital and the lateral as exoccipital. The old assumption that the supraoccipital is absent in the Amphibia can not be given any consideration, for the writer has made it out in *Trematops*, and it will probably be found in other Temnospondyli when looked for.

Von Huene (1912) supposed the supraoccipital to be present, and showed it in his drawings of the occiput. The part he designated as supraoccipital, however, forms less than one-third of the element.

The palates are poorly preserved in all of the Chicago specimens, from which the matrix had been removed, but as far as their elements could be made out, they agree with the descriptions of Case and Broom. As regards the dentition of the palatine, transverse and vomer bones, however, there is difference of opinion. Branson and Broom concluded that each of these bear one large tooth at a time, and explain the cases of two occurring at once as being due to the development of a second tooth, to replace the first, before the first happens to be shed. Case believed that there were normally two on each bone, with which view the writer is agreed. The number of cases in which two teeth are present and indistinguishable as to size or appearance in the specimens at hand, and in published drawings available, seems to show that two is the normal number, and that a less number is due to one or both being lost in preservation. The following table shows the conditions found:

Element.	Number examined.	Number having two teeth.	Number having none.	Number having one.
Vomer	16	5	9	2
Palatine	15	6	5	4
Transverse	13	4	6	3

It will be seen that two teeth are preserved about as often as one. These two, it may be mentioned, are similar in size and appearance in nearly every case. The fact that there are so often no teeth at all suggests strongly that these were broken off and lost, either before or after death, but more probably afterwards, and that where only one tooth is present the other has been thus lost. Owing to the large size and prominence of the teeth, a slight

amount of shifting about of the skull after death must have resulted in their being broken off, and indeed they must have been often broken off in life. The presence of fresh scars indicates the same fact. Where several scars are present, the extra ones will present a different appearance, owing to the healing of the broken surfaces.

Broom speaks of the surangular as an element of the lower jaw, and leads us to suppose that it is present as a separate element. Were this true it would be the only case known of an amphibian with a separate surangular bone. A careful examination, however, of several good jaws of the Chicago collection shows not the slightest evidence of the separation from the articular of the part of the jaw so designated. That this portion of the articular of the Amphibia was once a separate element in their ancestors, and corresponds to the surangular of reptiles, seems probable; but the fusion in *Eryops* is as complete as in other Amphibia. A well-preserved jaw of the Chicago collection shows the three coronoid bones as described by Broom.

A COMPARISON OF TEXAS AND NEW MEXICO MATERIAL.

The vertebrate faunæ of the Texas and New Mexico Permian are widely different from each other. Aside from the genus *Eryops*, only two genera, *Edaphosaurus* and *Diadectes*, are recognized to occur in both. *Dimetrodon* and *Clepsydrops* have been reported from the New Mexico Permian, years ago, but the negative evidence of later, more careful investigations is against their presence. Moreover, it is not unlikely that more complete specimens will show that those remains that have been referred to *Diadectes* represent really a closely allied but distinct genus. With such slight similarity between the faunæ of the two regions, there is especial need to make careful comparative studies of the specimens from the two regions that have been referred to these genera, in order to determine whether they are really generically identical.

Material and information concerning the New Mexican representatives of *Eryops* are scarce. Marsh (1878) first reported *Eryops* from New Mexico, but supposed he was dealing with the remains of a reptile, and described them under the name of *Ophiacodon grandis*. He gave us no information of value as to structure. Cope, in 1881, gave us the following description of *Eryops reticulatus*, without figures:

"The most prominent peculiarity of this species is seen in the neural spines, which are not expanded at the summit, as in *E. megacephalus*, but have rather contracted apices, Another character is the sharply reticulate

sculpture of the maxillary bones. The species is much smaller than *E. megacephalus*, or even than *T. insignis*, and the extent of the ossification of the vertebral elements is intermediate between the two species. The inferior surfaces of the intercentra are smooth, and the diapophuses are compressed. The occipital condyles are depressed, and not very well distinguished inferiorly. The humeri have expanded extremities, with enlarged epicondyles, well-developed condyles, and no epitrochlear foramen. Width of occipital condyles, m. .016; elevation of dorsal vertebræ, .024; width of intercentrum, .011; length of intercentrum (below), .207; five maxillary teeth in .015."

According to Case, the material upon which the description of Cope was based was mingled with the remains of other animals. Of Cope's material only the intercentra are known to-day, according to Case. We can not be certain, therefore, that the spines described by Cope did not belong to some other animal. Williston (1911) described briefly Marsh's material, but made no anatomical studies.

The present comparative studies are based upon two incomplete and poorly preserved skulls from New Mexico, one from the Yale Museum (No. 826), and one from the collection of the University of Chicago; and ten skulls from Texas, in the museum of the universities of Chicago and Kansas, and the published drawings of Case and Broom for specimens in the American Museum. Unfortunately, the skulls from New Mexico are in such poor condition that no satisfactory measurements or determinations of sutures could be made. The skulls are apparently shorter and broader than those from Texas, but this can not be established. There is one constant difference which is discernible, however, which is, in the opinion of the author, of generic rank. This is in the matter of the arrangement of teeth on the palatine, transverse and vomer bones.

In the skulls from New Mexico the two large teeth on each of these elements are without exception transverse in arrangement, while in the skulls from Texas they are without exception longitudinal with respect to each other, where both are present, or where fresh scars are present. Specifically, the condition in the skulls from New Mexico is as follows: Two transverse bones, one with two teeth arranged transversely, one with one tooth; three palatine bones, two with two teeth arranged transversely, and one with one tooth; four vomers, two with two teeth arranged transversely, one with one tooth and a fresh scar, arranged transversely, and the other with one tooth. In all the Texas skulls at hand there is not a single exception to the rule that the two teeth on each of these elements are longitudinal with respect to each

other, either where two teeth are present or where there are fresh scars.

Considering that there is not an exception in all the skulls or published drawings available, this character seems to indicate that the New Mexican specimens are distinct from those from Texas. No doubt, better-preserved material will show other important differences. If the materials described by Cope be of this animal, then the New Mexican specimens have the apices of the neural spines contracted, and differ in the character of the intercentra. The skulls at hand from New Mexico seem to be shorter and broader than those from Texas, but owing to the imperfection of the material this can not be proved. But until better material is secured we must rely upon this one character, which should be of generic rank. For the new genus the name *Eryopsoides* is proposed, and specimen No. 826 of the Peabody Museum is named as type. Whether Marsh's *Ophiacodon grandis* (1878) and Cope's *Eryops reticulatus* (1881) are the same species will perhaps never be known, since the type materials are lost; but since Marsh's name precedes, it should be adopted as the specific name for the New Mexico specimens referred to *Eryopsoides*.

While there is no particular interest in the mere fact of recognizing a closely allied but distinct genus, the recognition is in this case of considerable interest, since it shows that *Eryops* is not common to both regions. The faunæ of these regions, so far as known, have very little in common, *Edaphosaurus* and *Diadectes* being now the only forms recognized as common to both. It is not at all improbable that better-preserved specimens will show that the New Mexico specimens referred to *Diadectes* are really generically distinct, and that *Edaphosaurus* is the only genus common to both regions. This would indicate a faunal separation of the two regions, and the nature of the animals is such as to show that they developed parallel, rather than that they were separated in time, and one descended from the other.

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